



ISAKOS  
CONGRESS  
2023



**Boston**  
Massachusetts  
June 18–June 21

# INFLUENCE OF GRAFT POSITIONING DURING THE LATARJET PROCEDURE ON SHOULDER STABILITY AND ARTICULAR CONTACT PRESSURE: COMPUTATIONAL ANALYSIS OF THE BONE BLOCK EFFECT

Rita Martins, MEng

Carlos Quental, PhD, Prof

João Folgado, PhD, Prof

Ana Catarina Angelo, MD

Clara Azevedo, MD, PhD

PORTUGAL





ISAKOS  
CONGRESS  
2023



**Boston**  
Massachusetts  
June 18–June 21

The authors have no conflicts of interests regarding this presentation

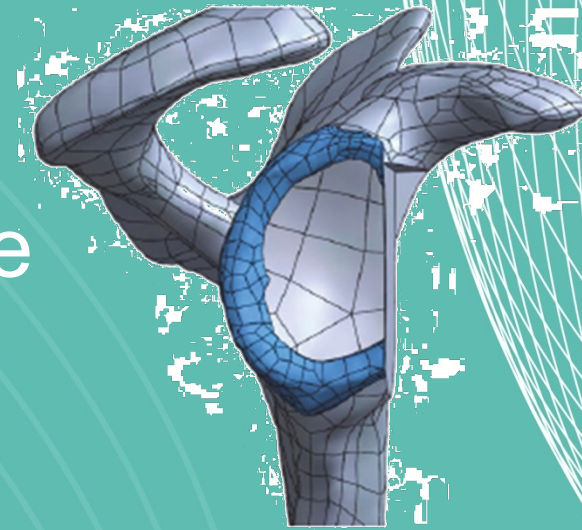


# BACKGROUND

The placement of the bone graft has a large influence on the efficacy of the Latarjet procedure

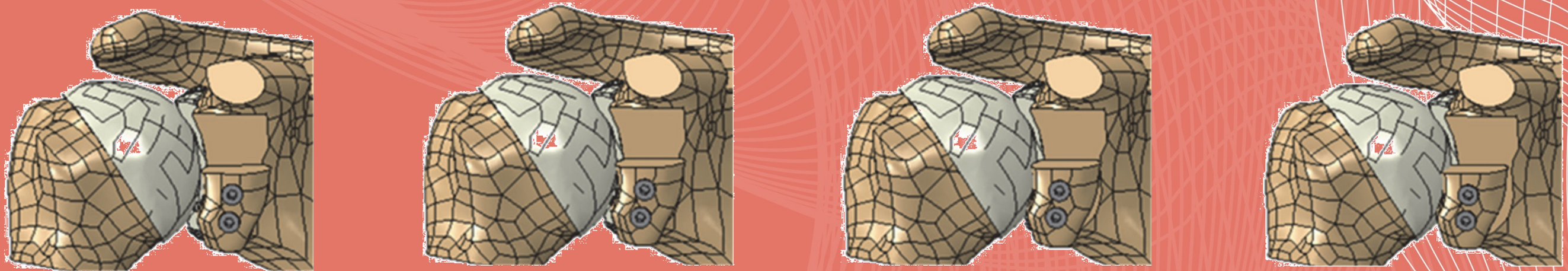
No clear indications exist on the best graft position

The aim of this study was to investigate the influence of the medial-lateral positioning of the bone graft on contact mechanics and GH stability due to the bone block effect



# METHODS

Four finite element (FE) models of a GH joint, with a 20% glenoid bone defect, treated by the Latarjet procedure were developed



The FE models differed in the medial-lateral positioning of the bone graft, ranging from a flush position to a 4.5 mm lateral position with respect to the flush position



# METHODS

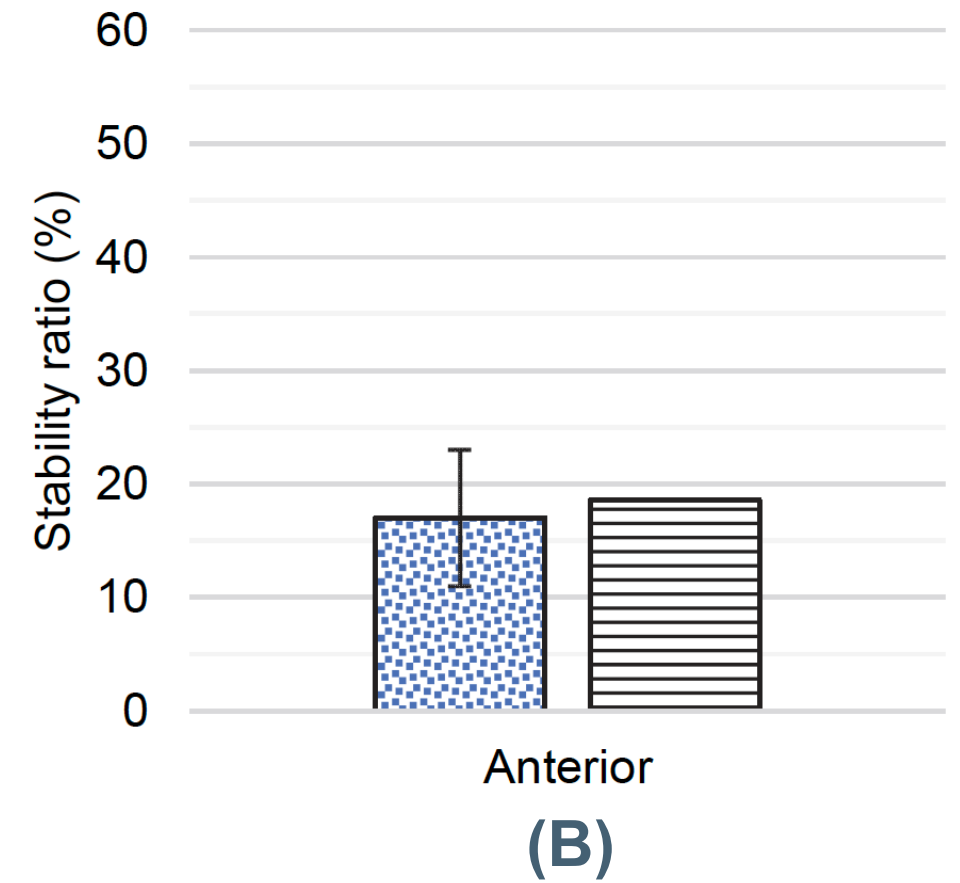
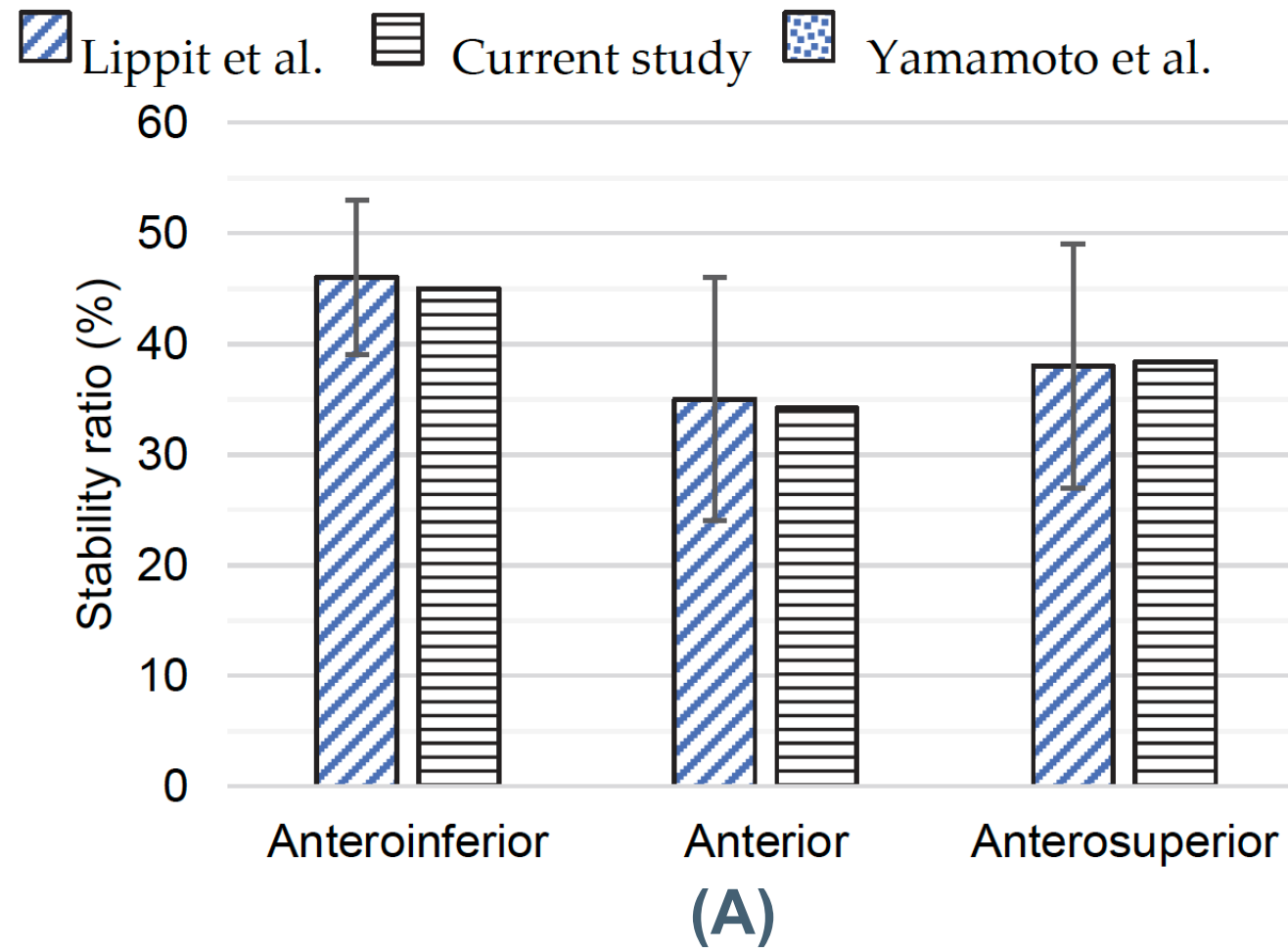
All graft placement options were evaluated for two separate shoulder positions

Anterior GH instability was simulated by translating the humeral head in the anterior direction, under a permanent compressive force, until peak translation force was reached. Joint stability was computed as the ratio between the shear and the compressive components of the force



# RESULTS

## STABILITY RATIOS FOR (A) THE HEALTHY GLENOHUMERAL JOINT MODEL AND (B) THE GLENOHUMERAL JOINT MODEL WITH A 20% GLENOID BONE DEFECT



# RESULTS

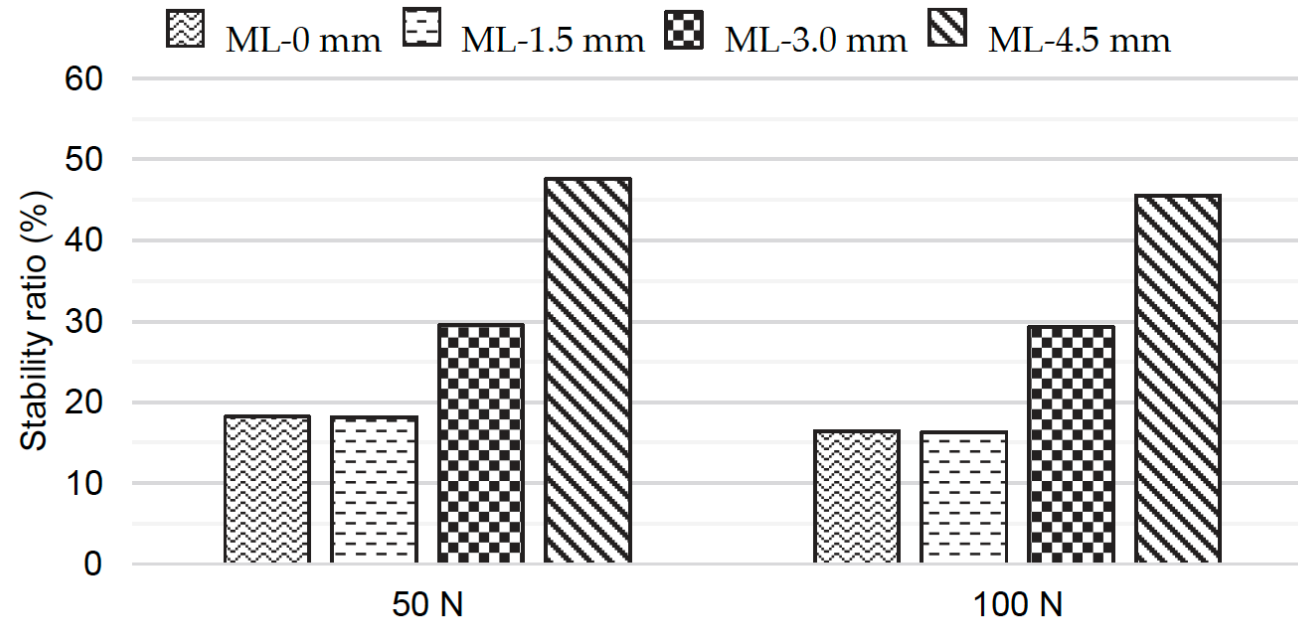
The lateralization of the bone graft increased GH stability due to the bone block effect after a 3 mm lateralization with respect to the flush position, regardless of the shoulder position

No differences in GH stability were observed between the flush and the 1.5mm lateral graft position and contact pressures were always below the failure stress threshold of articular cartilage (<29.5 MPa)



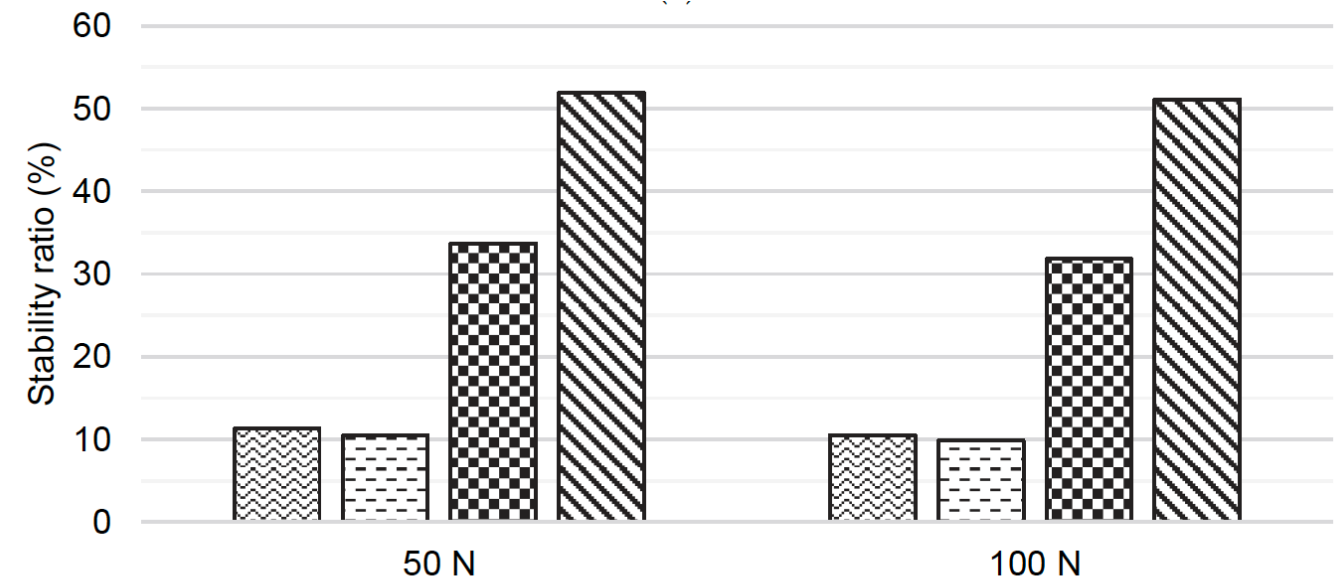
# RESULTS

## STABILITY RATIOS FOR THE GLENOHUMERAL JOINT MODEL WITH A 20% GLENOID BONE DEFECT AFTER THE LATARJET



(A) SHOULDER IN 0° ABD AND NEUTRAL ROTATION (B) IN 60° ABDUCTION AND 45° EXTERNAL ROTATION

(B) SHOULDER IN 60° ABDUCTION AND 45° EXTERNAL ROTATION





# RESULTS

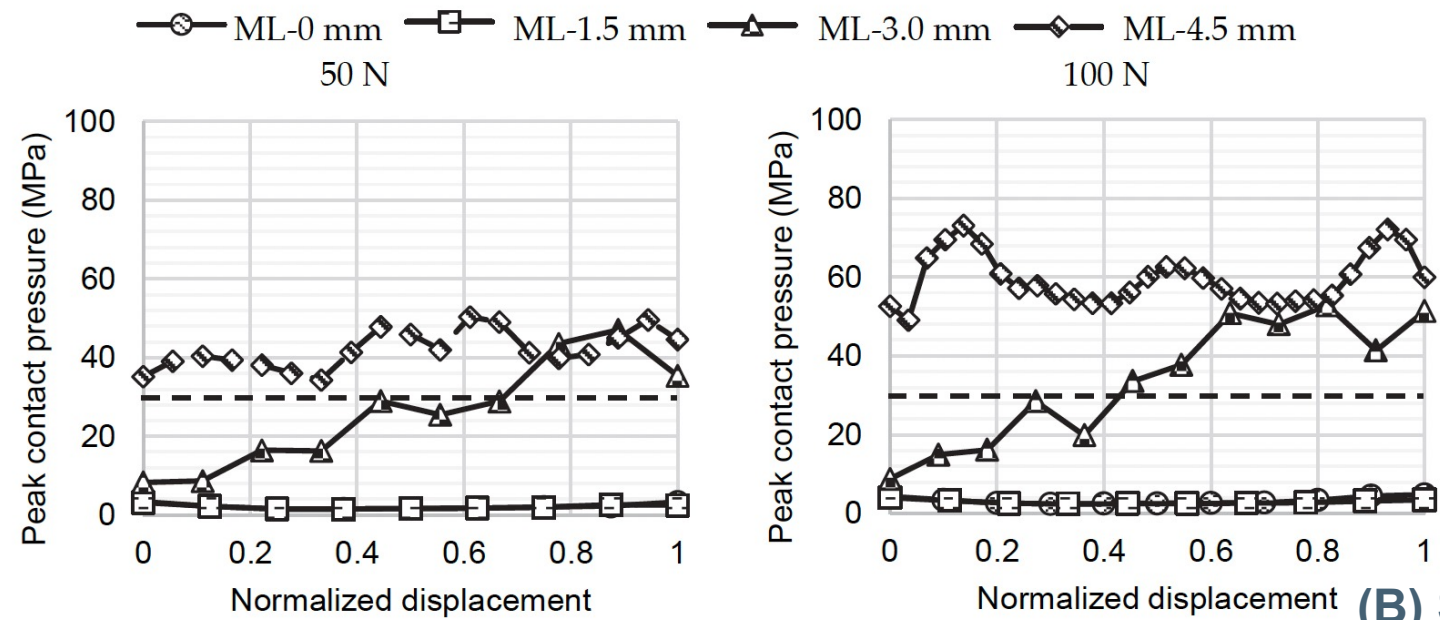
The increase in GH stability after the 3 mm lateralization was associated with an increase in peak contact pressure above the failure stress threshold of articular cartilage ( $>29.5$  MPa), due to the incongruous contact between the articulating surfaces

However, whereas this high peak contact pressure was only reached after some anterior translation of the humeral head for the 3.0mm lateralization, for the 4.5 mm lateralization, this high peak contact pressure was reached even before the humeral head was anteriorly translated

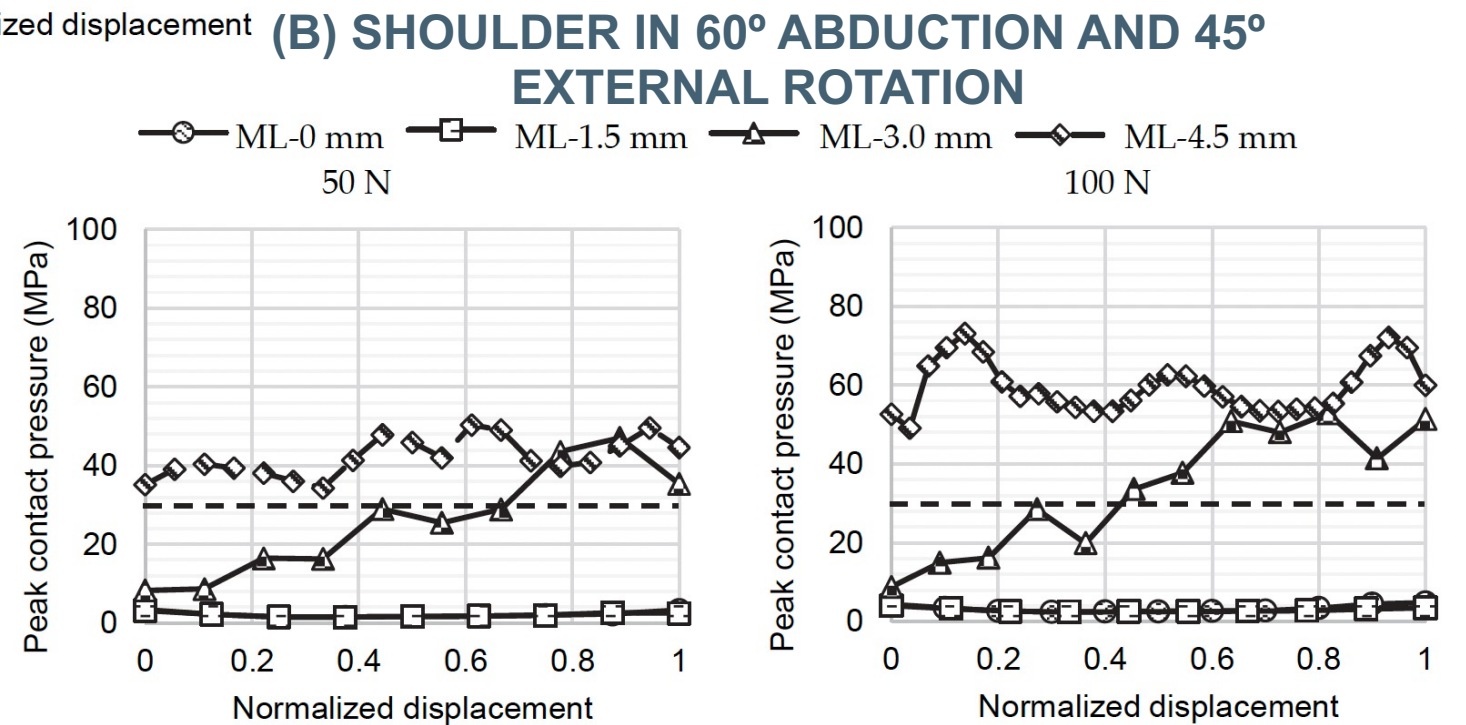


# RESULTS

## STABILITY RATIOS FOR THE GLENOHUMERAL JOINT MODEL WITH A 20% GLENOID BONE DEFECT AFTER THE LATARJET



**(A) SHOULDER IN 0° ABD AND NEUTRAL ROTATION (B) IN 60° ABDUCTION AND 45° EXTERNAL ROTATION**



# CONCLUSIONS

The sensitivity of the contact pressures to the medial-lateral positioning of the bone graft suggests a trade-off between GH stability due to the bone block effect and the risk of osteoarthritis, especially considering that an accurate and consistent placement of the bone graft is difficult in vivo.

For the modelled conditions, the best placement for the bone graft lied between a lateralization of 1.5 mm and 3.0 mm with respect to the flush position.



# REFERENCES

Yamamoto, N.; Itoi, E.; Abe, H.; Kikuchi, K.; Seki, N.; Minagawa, H.; Tuoheti, Y. Effect of an Anterior Glenoid Defect on Anterior Shoulder Stability: A Cadaveric Study. *Am. J. Sports Med.* 2009, 37, 949–954.

Lippitt, S.B.; Vanderhooft, J.E.; Harris, S.L.; Sidles, J.A.; Harryman, D.T.; Matsen, F.A. Glenohumeral Stability from Concavity- Compression: A Quantitative Analysis. *J. Shoulder Elb. Surg.* 1993, 2, 27–35.

Martins R, Quental C, Folgado J, Ângelo AC, de Campos Azevedo C. Influence of Graft Positioning during the Latarjet Procedure on Shoulder Stability and Articular Contact Pressure: Computational Analysis of the Bone Block Effect. *Biology.* 2022; 11(12):1783. <https://doi.org/10.3390/biology11121783>

